NON-PUBLIC?: N
ACCESSION #: 8804200389

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Calvert Cliffs, Unit 2 PAGE: 1 of 4

DOCKET NUMBER: 05000318

TITLE: Loss of Feed Trip Due to the Loss of Instrument Bus 22 (2Y10)
EVENT DATE: 01/22/88 LER #: 88-002-02 REPORT DATE: 04/15/88

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
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SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT: During troubleshooting of the three phase Unit 2 computer inverter, power was lost to the non-vital 208/120V A.C. Instrument Bus 22 (2Y10). The de-energization of 2Y10 resulted in reduced feedwater flow and caused the reactor to be tripped near the low steam generator level setpoint.

The loss of Instrument Buss 22 (2Y10) was caused by personnel error when a plant electrician's misinterpretation of electrical prints and unclear communications with the inverter vendor led to the placement of temporary jumpers in the inverter, causing a direct short circuit that was reflected back to the main power feed circuit breaker causing it to trip thus de-energizing Instrument Bux 22 (2Y10).

CORRECTIVE ACTIONS

1. A study of the proper size fusing and fuse to circuit breaker coordination is in progress.
2. Clarify the inverter manufacturers electrical prints to show the actual placement, in the circuit, of the power factor correction capacitors.
3. Investigate the use of "special" procedures in troubleshooting complex equipment.
4. All Maintenance Electricians will be trained on the details of this event as part of our continuing training program.

(End of Abstract)

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DESCRIPTION (Refer to the attached representative electrical print)

At 0957, January 22, 1988, while at 100% power and during the performance of troubleshooting activites of Unit 2 computer inverter (EIIS EC-INVT), a complete loss of power was experienced by the non-vital 208/120V Alternating Current (AC) Instrument Bus 22 (2Y10) (EIIS EC-BU). The de-energized loads included feedwater control isntruments: 2-PDIC-4516/4517, 2-PDT4516/4517 and 2-HIC-4516/4517. These loads are the feedwater regulating valve differentail pressure transmitters (EIIS SJ-PIT) and controllers (EIIS SJ-PDC), as well as the steam generator feed pump controllers (EIIS SJ-SCO).

When the power was lost, the input signal to the Unit 2 feedwater regulating Valves (EIIS SJ-V) was lost resulting in the initiation of a "Hold" (as is) signal to the Unit 2 steam generator feed pumps (SGFP) (EIIS SJ-P). The pumps continued supplying flow to the steam generators (EIIS SB-SG), but other loads were lost, including the solenoid valves (EIIS SB-V) that control the moisture separator shell side and the first and second stage drain tank control valves (EIIS SB-V). Upon loss of power, these control valves fail open, resulting in the water inventory being dumped to the condenser (EIIS SG-COND). The heater drain tank level fell, resulting in the heater drain tank level control valves shutting, reducing flow to the SGFP suction. The resulting change in SGFP Net Positive Suction Head (NPSH) reduced feedwater flow. The mismatch in 100% steam flow and reduced feedwater flow resulted in lowering steam generator levels. With no indication of the feedwater regulating valve differential pressure and no SGFP speed control (EIIS SJ-SC) at the feed control panel (EIIS SJ-SIK), the Operators could not increase the steam generator feed pump speed. Approximately four minutes following the loss of power to the Instrument Bux 22 was reenergized. The Operator actions, Emergency Operating Procedure (EOP)-0 (Post Trip Immediate Actions) and EOP-1 (Reactor Trip), for a loss of feed trip were completed and the reactor was stable at 1015. No Reactor Protective System (EIIS JC) or Engineered Safety Feature (EIIS JE) was required to activate with the exception of the Auxiliary Feedwater Actuation System (EIIS BA) which was automatically intiated. Calvert Cliffs Unit 2 has experienced a similar event as noted in LER 86-07.

CAUSE

The three phase computer inverter is a device that normally receives 120 volts direct current from a station battery bus (EIIS EI-BU) and inverts (changes) the direct current (DC) to 3 phase AC used by Unit 2 plant computer

(EIIS EC-CPU). In the event of a failure due to loss of the DC power to the inverter of an internal failure of the inverter, the inverter has the ability, automatically or by manual switching, to transfer the plant computer directly to analternate source of 3 phase 120 volts AC. The alternate source of AC power for the Unit 2 computer is the 208/120V AC Instrument Bus 22 (2Y10) Facility B. When the plant computer receives its input power directly from the instrument bus, the inverter cabinet swithces to act as a junction point to transfer the alternating current directly to the computer.

Prior to the inverter troubleshooting activities of 1/22/88, other arrangements had beenmade to pwer the plant computer and the inverter had been de-energized, i.e. no plant D.C. voltage inputand no Instrument Bus 22 A.C. voltage input. To facilitate troubleshooting, a dummy load bank was constructed (parallel 500 Watt lamps) to serve as an output load for the inverter. The plant electricians questioned the inverter vendor (Exide) representative on what to do whiththe power factor correction capacitors (EIIS EC-CAP) internal to the inverter cabinet. Unclear communications with the vendor and misinterpretation of electrical prints contributed to a personnel error by plant electricians when wire jumpers were placed across the power factor correcting capacitors. (See attached electrical electrical representation sketch.) The event was not influenced by any unusual characteristics of the work location.

With the dumy load attached to the A.C. output terminals of the inverter, and the capacitors jumpered, the electricians contacted an Operator to assist in starting the inverter in accordance with operating instructions. The first step was to close the D.C. (direct current) input breaker (EIIS EI-BKR) to the inverter. This breaker is located on a D.C. distribution panel (EIIS EI-PL) remote from the inverter. Closing this breaker had not effect on the inverter because the local, on inverter, D.C. input switches (EIIS EI-IS) were still open. The next step was to close the fuse manual disconnect switch (2Y10-80) (Eiis EC-DISC). Upon its closure, the instrument bus under-voltage relay actuated and the 2Y10 ground detectionlights (EIIS EC-GDET) extinguished. Breaker 2Y10-80 was reopened and approximately four minutes later Operations manually tripped Unit 2 reactor due to lowering S/G levels. Operations found that circuit breaker 52-20429 (EIIS EC-BKR) had tripped. This breaker was closed re-energizing Instrument Bus 22 (2Y10). With Breaker 2Y10-80 open, the plant electricians commenced testing and ascertained that the jumpers across the capacitors had caused a short circuit on the instruement bus.

Short circuit current fault tree:
1. Jumpers placed across the power factor correction capacitors cuased a direct electrical connection between the incoming phase to phase

and pahse to neutral power terminals.
2. When Breaker 2Y10-80 was closed, shore circuit current flowed between the A.C. line phases blowing two of the three 100A fuses (EIIS EC-FU) in Breaker 2Y10-80.
a. The two blown fuses are FRN 100A time delay.
The intact fuse is a 100A NON.
3. The three 250 A fuses inBraker 2Y10-77 did not blow.
4. Circuit braker 52-20429 tripped.
(a) 52-20429 provides power from motor control center (EIIS EC-MCC) 204R (ZB) to the primary of Transformer (EIIS EC-XRMR) 2X09. The tripping ofthis breaker was thedirect cause of the loss of Instrument Bus 22 (2Y10).

(b) This breaker is equiped with instantaneous electri-magnetic tripping devices that tripped the breaker before the down stream fuses in 2Y10-80 completely cleared the fault current.

ANALYSIS

The loss of feed trip occurred at 100% power, which is the worst possible power level for this transient. However, the loss of feedwater flow event is analyzed in Chapter 14.6 of the FSAR at 100% power with the feedwater regulating valves shutting instantaneously. Since, in this event, the feed flow was only partially reduced, this event is bounded by and is less severe than analyzed event.

CORRECTIVE ACTIONS

The following corrective actions are being taken to prevent reoccurrence:
1. A study of the proper size fusing and fuse to circuit breaker coordination is in progress.
2. Clarify the inverter manufacturers electrical prints to show the actual placement, in the circuit, of the power factor correction capacitors.
3. Investigate the use of "special" procedures in troubleshooting complex equipment.
4. All maintenance electricians will be trained on the details of this event as part of our continuing training program.

FIGURE OMITTED - NOT KEYABLE (ELECTRICAL REPRESENTATION OF

"SHORT CIRCUIT"
CURRENT PATH)

ATTACHMENT # 2 TO ANO # 8804200389 PAGE: 1 OF 1

BALTIMORE
GAS AND
ELECTRIC

NUCLEAR OPERATIONS DEPARTMENT
CALVERT CLIFFS NUCLEAR POWER PLANT
LUSBY, MARYLAND 20657

April 15, 1988

U.S. Nuclear Regulatory Commission Docket No. 50-318
Document Control Desk License No. DPR 69
Washington, DC 20555

Dear Sirs:

The attached LER 88-002, Rev. 02, is being sent to you as required by 10 CFR 50.73.

Should you have any questions regarding this report, we would be pleased to discuss them with you.

Very truly yours,

/s/ J. R. Lemons
J. R. Lemons
Manager - Nuclear Operations Department

JRL:JMO:plv

cc: William T.Russell
Director, Office of Management Information and Program Control
Messrs: J.A. Tiernan
W.J. Lippold

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